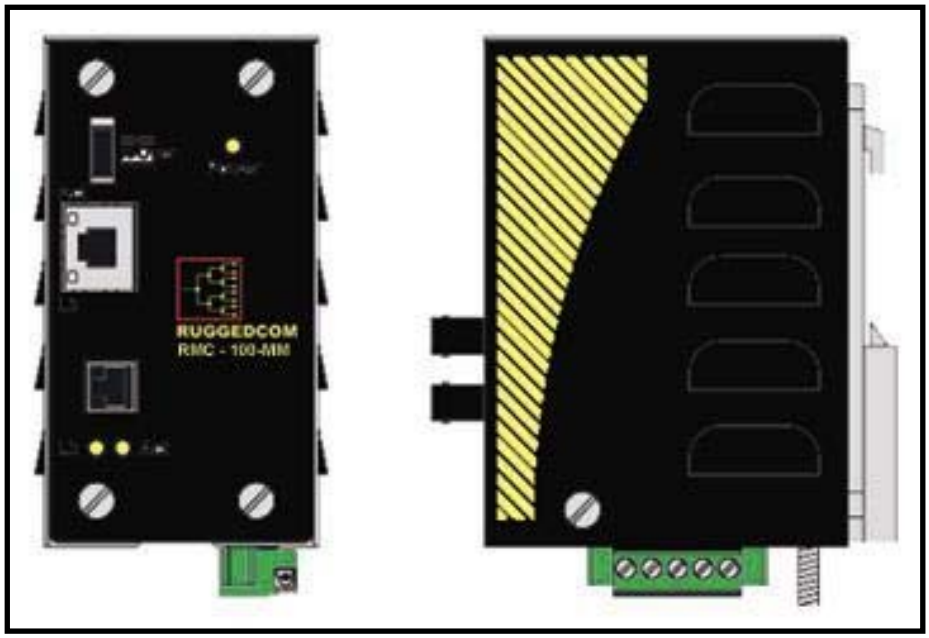
Rugged MediaConverter™

Installation Guide



RuggedCom Inc.
30 Whitmore Road,
Woodbridge, Ontario
Canada L4L 7Z4

Web: http://www.ruggedcom.com/
Tel: (905) 856-5288
Fax: (905) 856-1995
Toll Free: (888) 264-0006

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Trademarks:
***Ethernet** is a trademark of Xerox Corporation*
***Rugged MediaConverter and** Rugged**MC** is a registered trademark of RuggedCom Inc.*

Important:

The Rugged MediaConverter™ (Rugged*MC*™) contains no user serviceable parts. Attempted service by unauthorized personnel shall render all warranties null and void.

Warning: Changes or modifications not expressly approved by RuggedCom Inc. could void the user's authority to operate the equipment.

The Rugged*MC*™ should be installed in a restricted access location where access can only be gained by service personnel or users who have been instructed about the reasons for the restrictions applied to the location and about any precautions that shall be taken; and access is through the use of a tool or lock and key, or other means of security, and is controlled by the authority responsible for the location.

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1 Product Overview

1.1 Functional Overview

The Rugged MediaConverter™ is an industrially hardened fiber optical media converter specifically designed to operate in harsh environments such as those found in electric utility substations and factory floors. The Rugged*MC*™ family provides industrial strength Ethernet copper-to-fiber media conversion, allowing for 10BaseT-to-10BaseFL or 100BaseTX-100BaseFX over multi-mode or optional single-mode fiber optical media.

Specifically tested to the same standards as mission critical protective relaying equipment (i.e. ANSI/IEEE C37.90 and IEC 60255), and the newly issued IEC 61850-3 "Communications Systems and Networks in Substations" standard, the Rugged*MC*™ is ideally suited for substation or industrial environments. The reliability of the Rugged MediaConverter™ family exceeds that of commercial media converters by having no rotating mechanical parts (i.e. no cooling fans), utilizing high-temperature solid state components and incorporating the necessary transient and surge suppression circuitry required for substation and harsh industrial environments.

1.2 Feature Highlights

- Utility Grade (i.e. substation hardened) per ANSI/IEEE C37.90, IEC 60255, and the new IEC 61850-3 (2002), IEC 61000-6-5 standards
- Operating temperature: -40° to 85°C (no fan)
- Radiated RF Immunity: 35V/m per ANSI/IEEE C37.90.2
- Power supply options: 24 (10-36VDC), 48 (36-72) or HI (88-300VDC / 85-264VAC)
- Choice of two fiber optical modules:
  - 1 – 100BaseFX (100Mbps) multimode or optional single-mode fiber optical port
  - 1 - 10BaseFL (10Mbps) multimode or optional single-mode fiber optical port
- 1 – 10/100BaseTX Auto-Negotiating RJ45 port
- Configurable Full-Duplex, Half-Duplex or Fiber-side negotiation support
- Link Pass Through support
- TIA/EIA-785 100BaseSX support (10FL module only)

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1.3 RuggedMC™ Front Panel Description

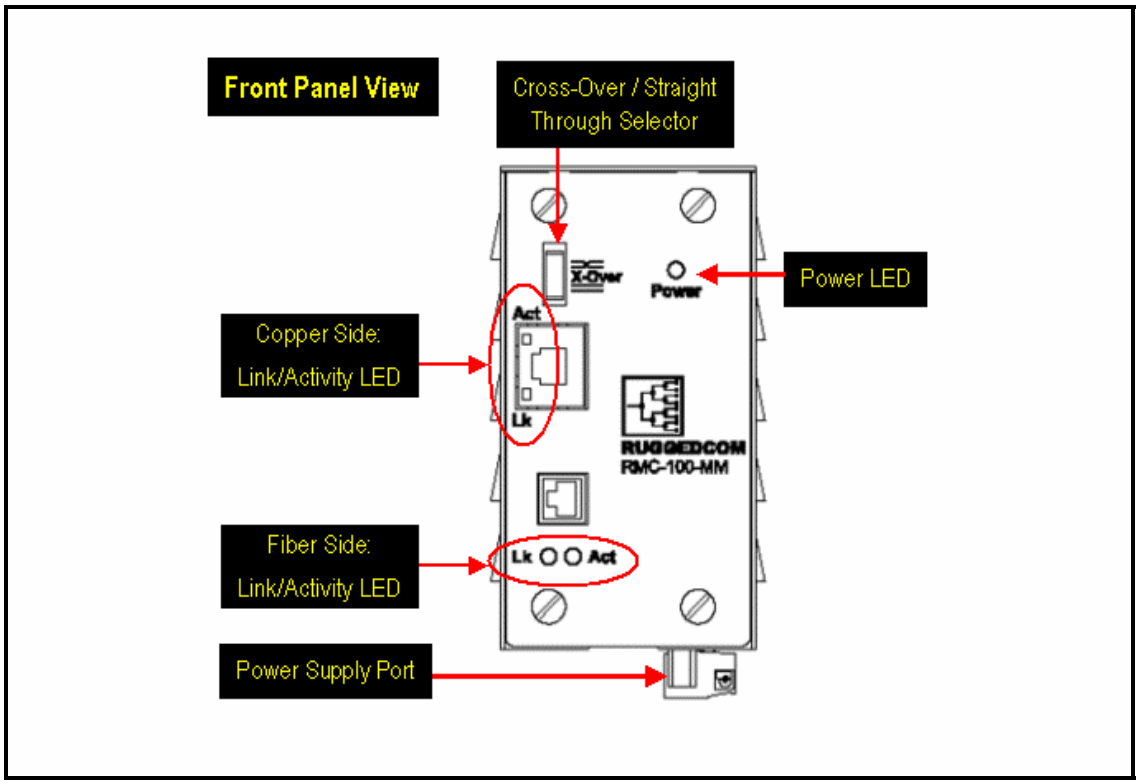

Fig. 1.3.1 Rugged*MC*™ Front Panel Detail

ITEM	*Activity*	*Comments*
Copper Side: Link	Solid (Yellow)	Link Established
Copper Side: Activity	Blinking (Yellow)	Tx, Rx Activity
Fiber Side: Link	Solid (Yellow)	Link Established
Fiber Side: Activity	Blinking (Yellow)	Tx, Rx Activity
Power LED	Solid (Green)	Power On

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1.4 RuggedMC™ Side and Bottom View

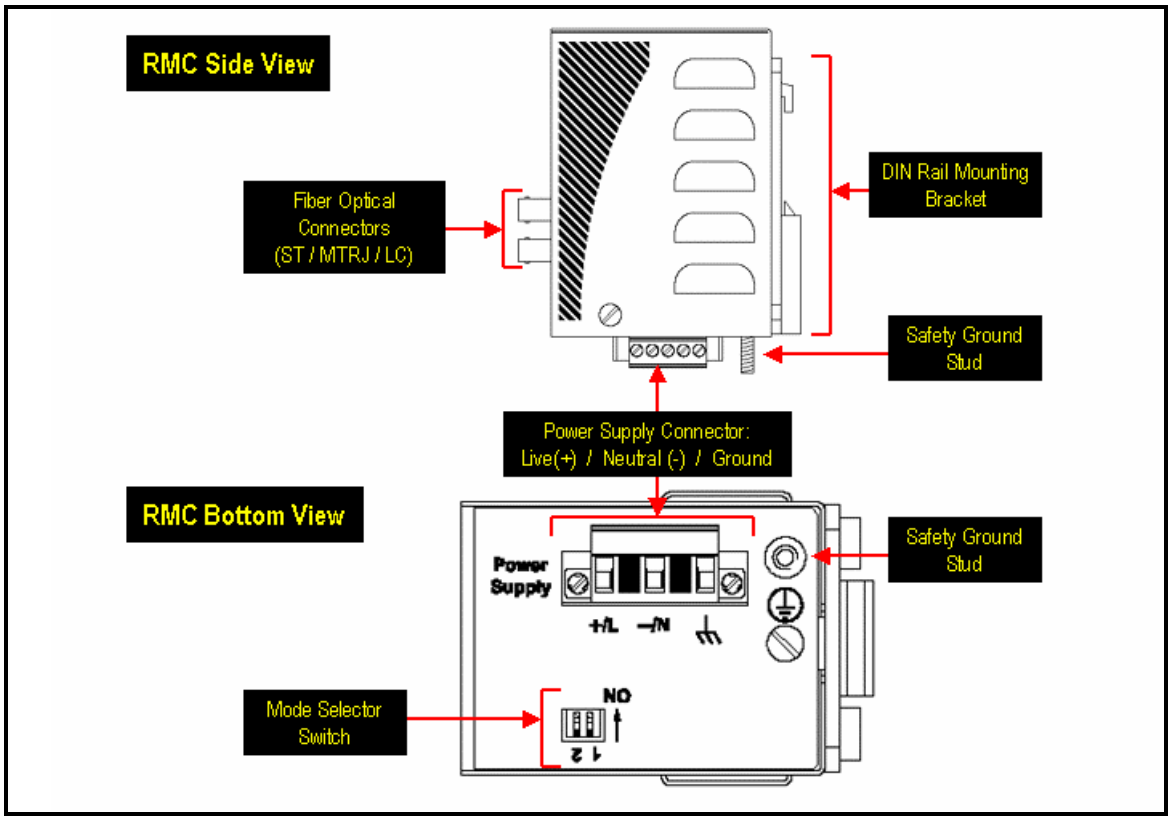

Fig. 1.4.1 Rugged*MC*™ Side and Bottom View

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2 Installation

2.1 DIN Rail Mounting

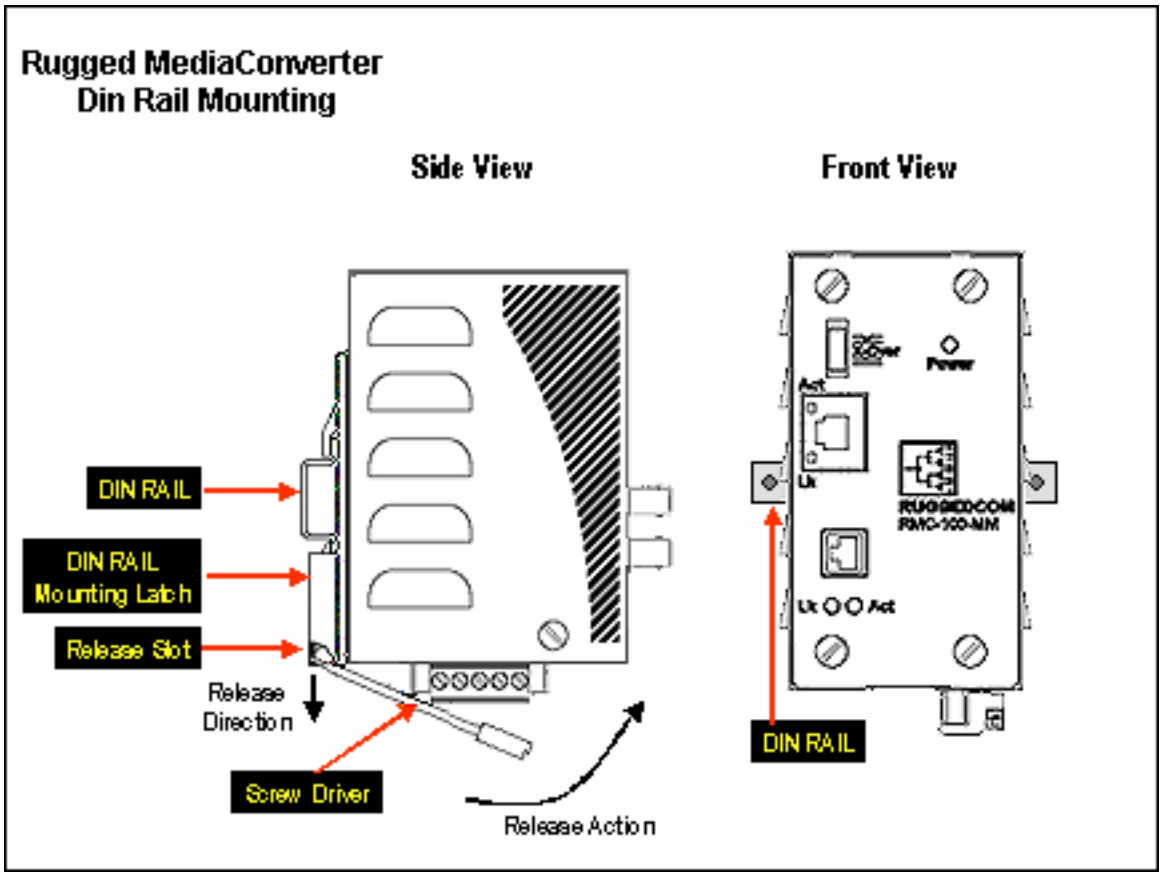

Fig. 2.1.1 Rugged*MC*™ DIN Rail Mounting

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2.2 Power Supply Wiring and Grounding

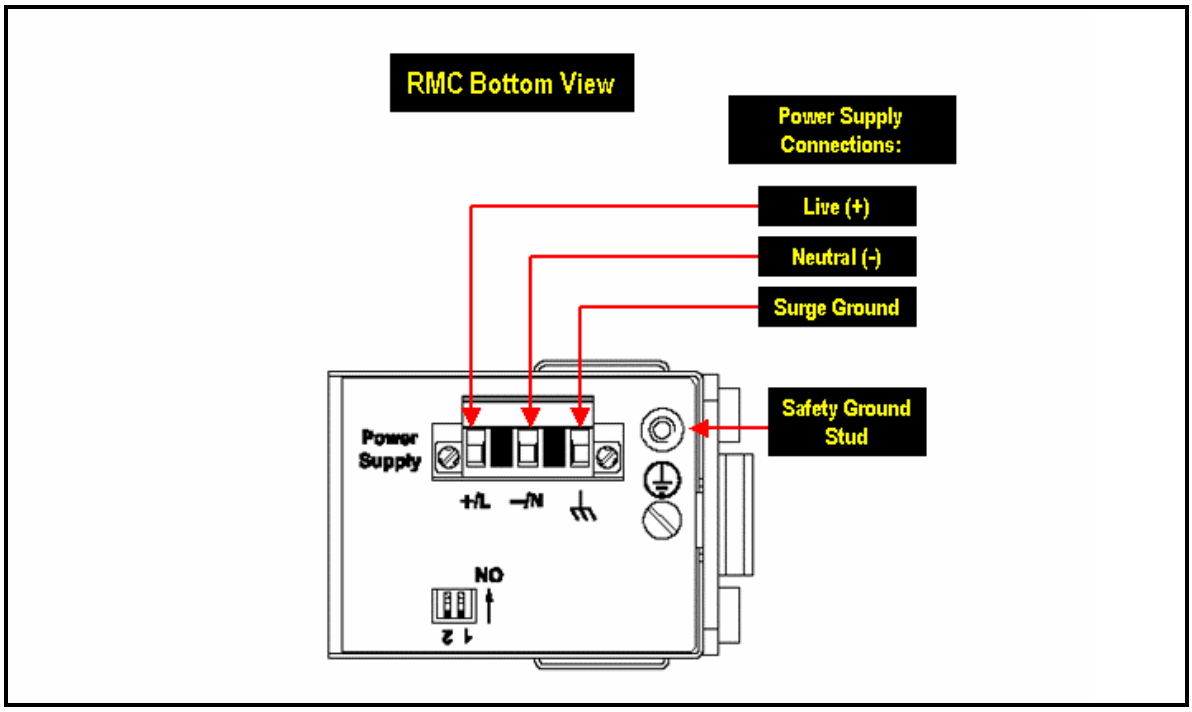

Fig. 2.2.1 Rugged*MC*™ Power Supply Inputs

The Rugged*MC*™ power supply inputs are identical and are connected as follows:

1. +/L = DC (+) / AC (Hot) is connected to the positive (+) terminal if the power source is DC or to the (Hot) terminal if the power source is AC.
2. -/N = DC (-) / AC (Neutral) is connected to the negative (-) terminal if the power source is DC or to the (Neutral) terminal if the power source is AC.
3. Surge Ground is connected to the Chassis Ground via a braided cable or other appropriate grounding wire. Surge Ground is used as the ground conductor for all surge and transient suppression circuitry internal to the Rugged*MC*™.
   Chassis Ground is connected to the Safety Ground terminal for AC inputs or the equipment ground bus *for DC inputs.*

Note: Surge Ground must be disconnected from Chassis Ground during HIPOT (dielectric strength) testing.

Notes:

1. *For 125/250VDC rated equipment: An appropriately rated 300VDC circuit breaker must be installed within 3 meters of unit.*
2. *For 110/230VAC rated equipment: An appropriately rated 250VAC circuit breaker must be installed within 3 meters of the unit*
3. *A circuit breaker is not required for 48 or 24VDC rated equipment.*
4. *For multiple supplies, separate circuit breakers must be installed. Equipment must be installed according to the applicable country wiring codes.*

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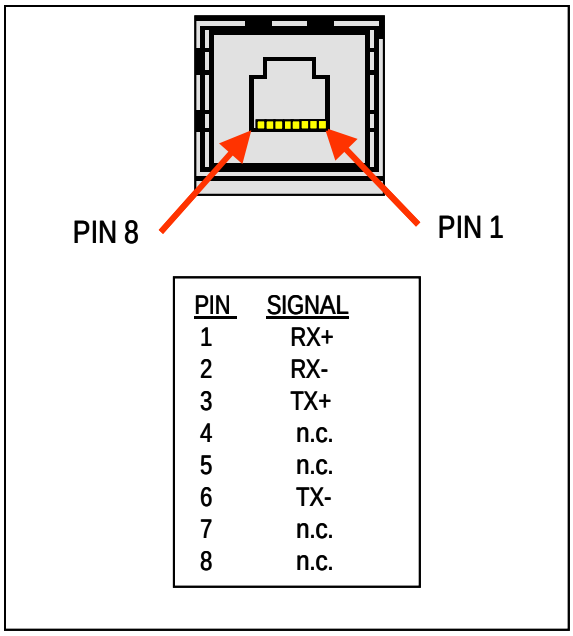
2.3 RJ45 Ports – Signal Description

The RJ45 port accepts standard category 5 unshielded twisted pair (UTP), or screened twisted pair (STP) cable with RJ45 male connectors. Fig. 2.3.1 shows the RJ45 port pin configuration.



PIN	SIGNAL
1	RX+
2	RX-
3	TX+
4	n.c.
5	n.c.
6	TX-
7	n.c.
8	n.c.

Fig. 2.3.1 RJ45 Port Pins

To accommodate signals from end devices as well as network switching equipment, the Rugged*MC*™ is equipped with a crossover selection switch.

Category 5 network cabling can be constructed in two configurations: Straight through, and crossover (X-over). Straight through cabling involves a pin-to-pin connection, while crossover cabling matches the transmitting differential pair to the receiving differential pair. Figure 2.3.2 summarizes the two possible configurations.

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TIA 568B Straight Through Pinout				TIA 568B Crossover Wiring Pinout			
Device 1		Device 2		Device 1		Device 2	
Pin	Colour	Pin	Colour	Pin	Colour	Pin	Colour
1	White/Orange	1	White/Orange	1	White/Orange	1	White/Green
2	Orange	2	Orange	2	Orange	2	Green
3	White/Green	3	White/Green	3	White/Green	3	White/Orange
6	Green	6	Green	6	Green	6	Orange

Fig. 2.3.2 Category 5 network cabling configurations: Straight through and Crossover

To accommodate both types of cabling, the Rugged*MC*™ contains a crossover selection switch visible on the front panel as shown on Fig 2.3.3. This switch will allow for the proper connection regardless of the cable type configuration.

When connecting to end devices, the X-over switch should be selected to reflect the type of cabling used. (i.e. Straight through is selected when using straight through cabling, X-over is selected when using crossover cabling)

X-Over Position	Description
UP	Crossover cabling is used to connect to end devices.
DOWN	Straight-through cabling is used to connect to end devices.

Figure 2.3.4 X-over switch positioning for Straight through and Crossover cabling

The presence of an active LINK LED indicates that the X-over selection switch is in the proper position.

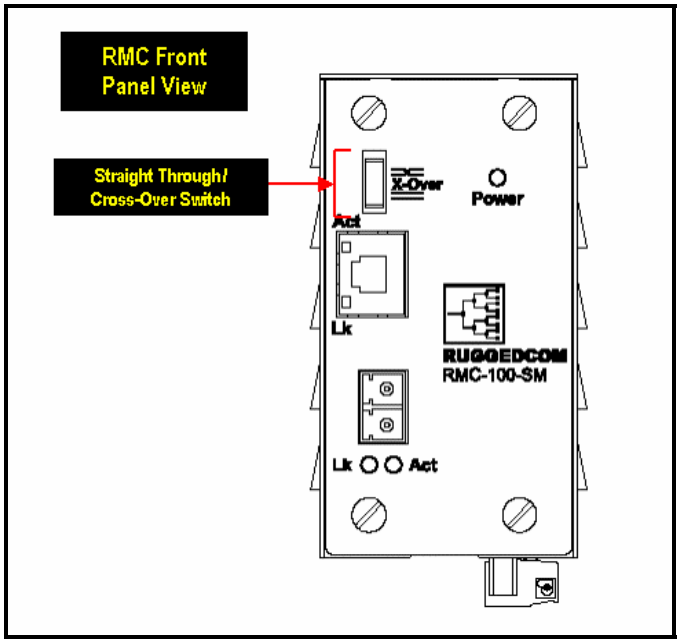

Figure 2.3.3 Location of X-over Switch on Rugged*MC*™

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NOTE: For substation applications it is not recommended to use these ports to interface to field devices across distances which could produce high levels of ground potential rise (GPR), (i.e. greater than 2500V) during line-to-ground fault conditions.

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2.4 Fiber Optical Port Configuration

To accommodate a wide array of fiber optical devices, the Rugged*MC*™ is equipped with a mode selector switch located on the bottom panel as shown in Fig 2.4.1.

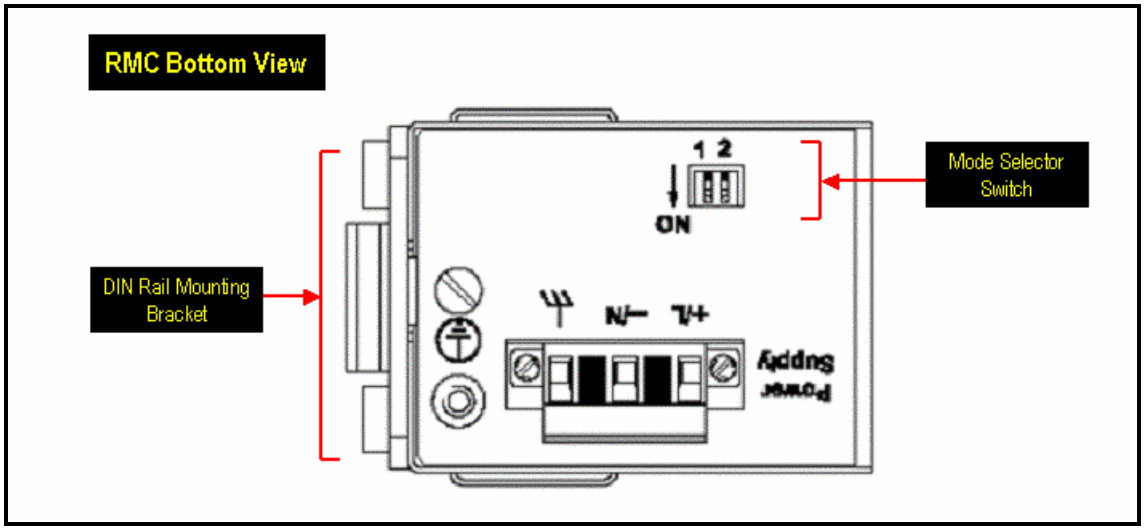

Figure 2.4.1 Mode Selector Switch located on the bottom of the Rugged*MC*™

The mode selector switch configures the Rugged*MC*™ to accommodate different fiber partners that operate at various duplex modes and speeds. Choose the appropriate operating mode according to the fiber link partner.

Configuration Mode	*Mode Selector Positioning*		*Description*
	SW1	*SW2*	
Transparent Mode*	OFF	OFF	10/100 Auto-negotiating transparent mode
HDX Mode	OFF	ON	Half-Duplex fiber partner
FDX Mode	ON	OFF	Full-Duplex fiber partner (default)
Reserved	ON	ON	

* Should ONLY be used on 10FL series Rugged*MC*™ products.

The transparent mode can be utilized when BOTH the copper side and fiber side devices are capable of auto-negotiating duplex mode and speed as per TIA/EIA-785. When both partners are capable of negotiation, the Rugged*MC*™ can support 100BaseTx to 100BaseSX, full duplex, copper-to-fiber media conversion on 10FL standard electronics and fiber media. The TIA/EIA-785 standard allows for 10FL communication lines that are less than 300m in length to be upgraded to 100Mb/s communication links.

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The HDX and FDX modes exist to accommodate fiber link partners that are operating in the forced mode. Due to the high number of forced full duplex fiber optical devices available, the factory default is the FDX, full duplex, mode.

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3 Technical Specifications

3.1 Power Supply Specifications

Power Supply Type	*Minimum Input*	*Maximum Input*	*Fuse Rating*	*Maximum Power Consumption*
24 VDC	18 VDC	36 VDC	3.15A(T) [2]	3 W
48 VDC	36 VDC	72 VDC	3.15A(T) [2]	
HI (88/300 VDC) [1] HI (120/240 VAC) [1]	88 VDC 85 VAC	300 VDC 264 VAC	3.15A(T) [2]	

Notes: 1 – This is the same power supply for both AC and DC.
2 – (T) Denotes time-delay fuse

CAUTION: For continued protection against risk of fire, replace only with same type and rating of fuse.

3.2 Networking Standards Supported

Parameter	*10FL Module*	*100FX Module*	*Notes*
IEEE 802.3	✓		10BaseT
IEEE 802.3u		✓	100BaseTX / 100BaseFX
IEEE 802.3x	✓	✓	Full Duplex Operation
TIA/EIA 785	✓		10/100BaseSX Capable

All Rugged*MC*™ products feature Link Pass Through support. When loss of link is detected on either the fiber side or the copper side, link pulses are no longer transmitted on any of the Rugged*MC*™ ports. This feature allows for prompt loss of link detection and user correction. The faulty link partner can be identified by loss of link on the Rugged*MC*™ front panel indicators.

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4 Data Port Specifications

4.1 Copper Port Specifications

Data Port	Media	Distance	Connector Type
10/100 Mbps Auto-negotiating	Cat 5 UTP/STP	100m	RJ45

4.2 Fiber Optical Specifications

Parameter	10Mbps Ports		100Mps Ports	
	Multi-Mode	Single-Mode*	Multi-Mode	Single-Mode*
Speed Standard	10BaseFL		100BaseFX	
Connector Type	ST		MTRJ	LC
Segment Length	2 km	15 km	2 km	15 km
Optical Wavelength	820nm	1310nm	1300nm	1310nm
Cable Size Core/Cladding	62.5/125µm	9/125µm	62.5/125µm	9/125µm
Optical Tx Power Min/Max (dBm Peak)	-13.5/-7.6	-23/-15	-16/-11	-15/-8
Optical Rx Sensitivity (dBm Average)	-34.4	-38	-33.5	-31
Max Optical Rx Power (dBm Peak)	-8.2	-3.0	-11	-5
Typical Optical Power Budget (dB)	22	18	17	16.5

* Available as an option

4.3 Networking Specifications

Parameter	10FL Module	100FX Module	Notes
Latency	1 µS	1 µS	Cut-through conversion

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5 Type Test Specifications

Electrical Safety	*Levels*	*Comments*
Dielectric Withstand	2 kV rms for 1 minute	ANSI/IEEE C37.90 (1989) IEC 60255-5 (Section 6)
High Voltage Impulse	5 kV peak	IEC 60255-5 (Section 8)
Insulation Resistance	500 VDC for 1 minute	IEC 60255-5 (Section 6

Electrical Environment	*Levels*	*Comments*
High Frequency Disturbance (Oscillatory)	2.5 kV @ 1MHz for 2s	ANSI/IEEE C37.90.1 IEC 60255-22-1
IEC Surge	4 kV / 2 kV	IEC 61000-4-5 (Level 4)
IEC Fast Transient	2 kV / 1 kV	IEC 61000-4-4 (Level 4)
ANSI/IEEE Fast Transient	4 kV	ANSI/IEEE C37.90.1
IEC Radiated RFI Immunity	10 V/m	IEC 61000-4-3
ANSI/IEEE Radiated RFI Immunity	35 V/m	ANSI/IEEE C37.90.2
ESD (Electrostatic Discharge)	15 kV (air discharge) 8 kV (contact)	IEC 61000-4-2 (Level 4)

Atmospheric Environment	*Levels*	*Comments*
Temperature (Dry Cold)	-40°C	IEC 60068-2-1 Test Ad: 16 hrs @ -40°C
Temperature (Dry Heat)	85°C	IEC 60068-2-2 Test Bd: 16 hrs @ 85°C
Humidity	95% Non-condensing	IEC 60068-2-30 Test Db: 6 cycles, 55°C, 95% Humidity

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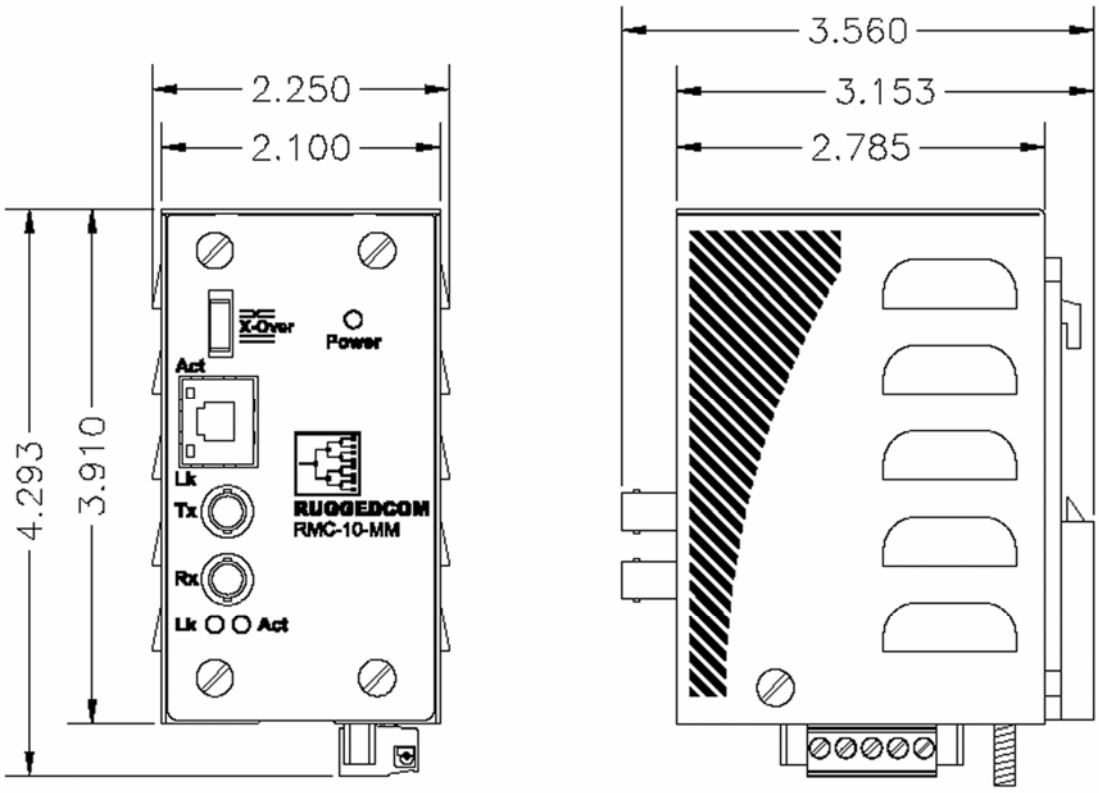
5.1 Operating Environment

Parameter	Range	Comments
Ambient Operating Temperature	-40 to 85°C	Ambient Temperature as measured from a 30cm radius surrounding the center of the Rugged*MC*™ enclosure.
Ambient Relative Humidity	5% to 95%	Non-condensing
Ambient Storage Temperature	-40 to 85°C	

5.2 Physical Dimensions



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Parameter	Value	Comments
Dimensions	3.55 x 2.07 x 3.86 inches (90,35) x (52,59) x (98,04) mm	(Length x Width x Height)
Weight	1.5 lb (0,68 Kg)	
Enclosure	21 gauge Galvanized Steel	

5.3 Agency Approvals

Agency	Standards	Comments
cCSAus, CE	CSA C22.2 No. 60950, UL 60950, EN 60950, EN 61000-6-2	PENDING

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6 Warranty

Five (5) years from date of purchase, return to factory. For warranty details, visit *www.ruggedcom.com* or contact your customer service representative.

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